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(54) Title of the Invention: CONTINUOUS DEOILING METHOD FOR GLASS FIBER SYSTEM WOVEN CLOTH

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SPECIFICATIONS

1. Title of the Invention: Continuous Deoiling System for Glass Fiber System Woven Cloth

2. Scope of the Patent's Claims

A continuous deoiling system for glass fiber system woven cloth, characterized by the fact that during the first stage, a high-pressure water steam jet is formed in the vicinity of the surface of a woven cloth in a bath when a long glass fabric type of the original fabric cloth is fed continuously in the spread out status, and while the woven cloth travels through a water bath which is heated to at least 50°C, the cavitation effect is induced and impact pressure is applied;

wherein during the second stage, a water current having a very small diameter is sprayed at a high speed with a high-pressure water spraying device onto the surface of a woven cloth which has passed through the water bath during the first stage.

3. Detailed Explanation of the Invention

(Sphere of Industrial Use)

This invention relates to a method for continuous deoiling by applying a water system which to the original woven yarn containing woven cloth which can include only a glass fiber system, or a glass fiber system interwoven with another organic or inorganic fiber (hereinafter referred to as glass fabric woven system cloth).

(Prior Art Technology)

It is desirable when the original fabric of a woven glass fiber cloth is processed in such a way so that fats and oils, consisting primarily of a binder and starches, are removed through deoiling treatment which removes starches, fats, and oils adhering to the structure of the fiber, which can be followed by a surface treatment, a resin impregnation treatment, etc., in order to obtain a fiber having the desired specification with this treatment.

According to the continuous wet treatment method, which one method that can be used for the above mentioned deoiling treatment, acids, alkali, detergents, oxygen, etc., can be used in aqueous solution, together with heating at a high temperature which serves to remove incineration residue with drying according to the continuous method or according to the batch method. However, the problem is that this continuous wet processing method not only takes a long time, but another problem is that the result of deoiling is often not satisfactory, and when the continuous high-temperature method is used, adjustment of the processing conditions is difficult and uneven deoiling results can easily occur. That is why according to this method, the original fabric is rolled on rolls and the high-temperature heating deoiling method is generally applied with the batch processing method so that heating is applied for 30 ~ 60 hours at a high

temperature of 300 ~ 500°C in a heating oven.

(Problems To Be Solved By This Invention)

Although the above mentioned batch processing heating deoiling method can be used for a homogenous removal of starches, oils, fats, etc., which adhere to the original fabric, with thermal decomposition gases, a very serious damage is unavoidable when this method is applied to a glass fiber fabric so that heat processing is used for a relatively long period of time. This method is also costly due to energy required for the equipment and the operations. Therefore, this method has not necessarily been a satisfactory method.

That is why the authors of this invention studied deoiling methods using continuous water system processing in order to resolve the above mentioned problems connected with deoiling methods according to prior art and discovered a continuous deoiling method wherein a high-pressure water current spraying treatment is conducted after a hot water treatment. This method was disclosed in Japanese Patent Application Number Hei 1-291259.

However, since the above mentioned invention is restricted by the conditions of the hot water treatment with respect to the speed of processing, in order to increase the feeding speed during the processing, a large size of the hot water tank must be used, which again required an increased length of the traveling path of the woven fabric inside the bath.

(Means To Solve Problems)

In order to improve the hot water treatment conditions of the above mentioned invention, a more effective construction has been created enabling an optimal deoiling result. Specifically, to summarize the continuous deoiling method of this invention, this method comprises:

a high-pressure water steam jet, created in the vicinity of the surface of a woven cloth in a bath when a long glass fabric type of the original fabric cloth is fed continuously in the spread out status, and while the woven cloth travels through a water bath which is heated to at least 50°C, the cavitation effect is induced and impact pressure is applied during the first stage;

wherein during the second stage, a water current having a very small diameter is sprayed at a high speed with a high-pressure water spraying device on the surface of a woven cloth which has passed through the water bath during the first stage.

The glass fiber system woven cloth which has been processed by the deoiling processing of this invention contains a glass fiber system woven cloth which is interwoven with an organic fiber system and an inorganic fiber system in addition to the glass fiber of the glass fiber system. Because a binder and a starching agent adhere to the glass fabric system of this original woven fabric cloth, and in some cases a starching agent adheres also to the fiber system of the interwoven cloth, these processing agents must be removed from the original cloth with a

Japanese Patent Application Number Sho 61-230900.

When said high-speed water current having a fine diameter is sprayed on the surface of a glass fiber system woven cloth which has been steeped in hot water, the woven cloth will become swollen, making it possible to remove the treatment agents adhering to the cloth with the required spraying energy. Normally, water can be supplied under high pressure for a spraying formation with a pressure of 30 ~ 500 kg/cm^2 from spraying nozzles which have a diameter in the range of 0.1 ~ 0.5 mm and which are positioned at a distance of 10 ~ 100 mm from the surface of the traveling woven cloth.

In addition, the back-and-forth movement of the headers containing an arrangement of liquid spraying nozzles in the direction of the width of the woven cloth can be conducted as a linear movement in parallel to the surface of the woven cloth, or a rotating movement can be applied. The stroke of this back-and- forth movement and the rotation radius of this rotating movement and the moving cycle can be set so as to obtain a homogenous effect, which is related to the moving speed of the woven cloth, the shape of the arrangement, and the pitch set for the liquid spraying nozzles.

When the spraying treatment with a high-speed water current having a fine diameter is finished, washing, cross-washing, and drying is conducted during the textile deoiling treatment and if necessary, it is also possible to conduct a coupling agent treatment and impregnation with a synthetic resin during the textile processing treatment.

(Operation)

When the original woven cloth containing only the glass fiber yarn of this invention, or in addition to this yarn, also a carbon fiber yarn, or a synthetic fiber yarn combined with the glass fiber yarn, is treated by a powerful impacting force due to the effect of the cavitation which is created by spraying of water steam using a high pressure and a high temperature in the heated water bath during the first stage of the manufacturing process, the expanding through water is accelerated and the force of adhesion is reduced during a relatively short time period in the layer containing a binding agent and a starching agent. This enables a very effective separation and removal of the layer during said treatment when a water current is sprayed with a fine diameter at a high speed onto a desired surface having a small surface area, which makes it possible to produce an optimal deoiled original yarn without causing deterioration due to strongly detrimental changes in the structure of the filament.

(Embodiments)

The following is an explanation of an embodiment of the continuous deoiling method of this invention which uses a treatment device indicated in a simplified profile diagram shown in Figure 1.

Figure 1 shows a treatment device , comprising a water bath treatment device I, high-pressure water jet spraying treatment device II, and drying device III.

Water bath treatment device I is used to supply water with a temperature in a desired range, from 50 to 99°C, to heating water supplying pipe 11 inside tank 10. The water level is maintained at a constant level through an overflow which is provided on one end of the tank, the inner part of the tank is submerged in the water, and 3 revolving guiding rolls, roll 12, 13, and 14 [Translator's Note: The numbers listed in the Japanese text do not seem to correspond in every case to the numbers of the parts shown in the figure] are also deployed so that they are capable of rotating movement. Number 17 indicates a steam heating pipe which is installed on the bottom of the tank.

The first guiding roll 12 and the third guiding roll 14 are deployed in the vicinity of respective woven cloth introduction contact points, and water steam spraying pipes 15 and 16 are mounted in parallel to the axis of the guiding rolls.

Saturated water steam is supplied from water steam supplying pipe 18 to these water steam spraying pipes 15 and 16 at 4 ~ 10 kg/c^2 at 143°-180°C and spraying openings with an opening diameter of 1.0 mm are created with a pitch of 3 mm in the axial direction of the pipe on the wall opposite the guiding rolls 12 and 14 of said water steam spraying pipes 15 and 16.

High-pressure water spraying treatment device II is located adjacent to the upper surface of the woven cloth in a parallel traveling path. The device is provided with headers 20 and 21 having an eccentric rotating mechanism enabling a horizontal circular movement with 1,000 rpm using a rotation diameter of 20 mm, extended in the direction of the width of the woven cloth, and connected to water spraying nozzles which are created with an opening diameter of 0.1 mm using a pitch of 20 mm in the direction of the width of the woven cloth under the lower surface of headers 20 and 21.

Drying device III is provided with finishing water washing tank 31 and constricting dehydrating roll 32 which are mounted on the side where the woven cloth enters the system.

Number 40 indicates a water drain pipe for overflow water from respective water washing tanks 22, 23, and 31 of drying device III and from high-pressure water spray treatment device I.

Woven cloth C which is extruded from the original cloth take-up roll R for woven cloth takes up the original cloth so that it is continuously transported to water bath treatment device I of in said treatment device, as well as to high-pressure water jet spraying treatment device II, and to drying device III, enabling to obtain a deoiled yarn according to the continuous deoiling method of this invention.

Embodiment 1

A smooth glass woven cloth (manufactured by the Nitto Boseki Co., Ltd., WEA 18 w, unit weight 209 g/m^2, a starched type provided with a binding agent, containing an added starching with a ratio corresponding to 2.0 weight percent) was used for the original treated yarn, the traveling speed of the woven yarn was 5 m/min and deoiling was conducted with continuous operations under the conditions of said processing device which are described below.

The temperature of the water bath to which water was supplied in water bath treatment device was set to 90°C, and while the temperature was maintained in the range of 85 ~ 92°C inside the water tank with steam heating pipe 17, the water path passage time period of the woven cloth was set to 40 seconds.

While saturated water steam was supplied with 8 kg/cm^2 at 158°C, a continuous impacting pressure was thus created by the cavitation created in the vicinity of the woven cloth entry introduction point of guiding rolls 12 and 14.

The water pressure supplied to headers 20 and 21, performing a horizontal circular movement in high-pressure water jet spraying treatment device II, was set to 80 kg/cm^2. This made it possible to remove the binding agent, etc., with a removal ratio of 99%, enabling to obtain deoiling finish specifications without any noticeable decrease of the drawing strength of the fiber.

Embodiment 2

Except for the fact that the traveling speed of the woven cloth of Embodiment 1 was set to 10 m/min, the time of the passage period in the water bath treatment device was set to 20 seconds, and the water pressure supplied to headers 20 and 21 in the high-pressure water jet spraying treatment device was set to 100 kg/cm^2, the conditions of the deoiling operations were completely identical to those of Embodiment 1.

The binding agent, etc., was removed under these conditions with a ratio of 97%, and deoiled finishing specifications were obtained again without any noticeable decrease of the drawing strength.

Embodiment 3

A polyether imide woven fiber interwoven with a glass woven fiber system identified below was used for the treated original yarn.
Used Yarn:

Vertical Yarn:

S glass woven fiber yarn * 1 (TCK-37, manufactured by the Nitto Boseki Co., Ltd.).
polyether imide yarn *2 (110 tex).

Horizontal Yarn:

S glass woven fiber yarn (same as above),
polyether imide yarn (same as above).

Density (filaments/25 mm)

Vertical Yarn:

S glass woven fiber yarn	20
polyether imide yarn	20

Horizontal Yarn:

S glass woven fiber yarn	18
polyether imide yarn	18

Roughness of the Weave:

regular twill weave.

Adhesion Ratio of Binding Agent:

0.8 weight percent.

*1: A monofilament glass fiber with a diameter of 13 μ, the yarn count was 137 tex (a glass fiber characterized by a high SiO_2 content, high strength and high elasticity).

*2: Spun and drawn yarn, without heat setting.

To reduce shrinking of the polyether imide yarn cloth described above cloth which was subjected to heat contraction under the temperature mentioned below, the water temperature inside water bath treatment device I was set to 50°C, the traveling speed of the interwoven fiber was set to 2 m/min, and the passage time period of the water bath treatment was set to 100 seconds. Otherwise, the processing conditions were identical to those of Embodiment 1. The product was formed with deoiled finishing specifications using thermo-compression with an optimal shape without warping due to contraction. The binding agent removal ratio was 98%, and there was no noticeable decrease of the drawing strength.

Comparative Example

The same glass fiber original yarn which was used in Embodiment 1 was processed by the

take-up roll, using high-temperature heat treatment with 230°C, 10 hours, as well as 350°C and 60 hours to obtain a deoiled original yarn. Although the binding agent removal ratio of this yarn was 99%, the drawing strength ratio of this yarn was only 35%, which is a remarkably poor ratio.

In each of the above described embodiments as well as in the comparative example, the removal of the binder, etc., and the drawing strength maintenance ratio values were measured according to the general testing method for glass woven fibers defined in JISR 3420. The removal ratio of the binding agent, etc., in Embodiment 3 was measured while excluding the polyether imide yarn from the woven cloth, only the glass fiver was measured with the heat reduction amount method, and the polyether imide yarn was washed and dried before measuring and the total value was obtained.

In addition, although the above explanation of said embodiments is based on a deoiling treatment using a treatment device comprising a high-pressure water jet spraying treatment device which used 2 individual headers and a water bath treatment device which was provided with 2 water steam spraying pipes, the number of the headers and of the water steam spraying pipes can be generally reduced or changed depending on the conditions of the woven cloth filament.

(Effect of the Invention)

The continuous deoiling method of this invention makes it possible to conduct the deoiling treatment very efficiently, while deterioration of the drawing strength of a glass fiber system woven cloth is prevented when the above described construction and operation is used. In addition, the design provides an important effect for industrial purposes because the equipment required for treatment is simple and a small size is sufficient, and also the amount of energy required for operations is small.

4. Brief Explanation of Figures

Figure 1 shows a simplified profile view of a treatment device used in an embodiment of this invention according to the method of this invention.

I	...	water bath treatment device,
II	...	high-temperature water jet spraying treatment device,
III	...	drying device,
10	...	heating water supplying pipe,
12, 13, 14	...	guiding rolls,
15, 16	...	water steam spraying pipe,
18	...	water steam supplying pipe,
20, 21	...	headers,
C	...	woven cloth.

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